

22. (Amended) The method of Claim 21, wherein compensating for substrate drift comprises changing the position of the robot supporting the process substrate in accordance with the following formulae:

$$\Delta\theta = \sin^{-1}\left(\frac{-x}{\sqrt{x^2 + (g + \delta + y)^2}}\right)$$

$$\Delta R = g + \delta - \sqrt{x^2 + (g + \delta + y)^2}$$

where ΔR indicates a compensating change along the translation axis, $\Delta\theta$ indicates a compensating change in rotational position, g is calculated from the formula of Claim 21, (x, y) are calculated from the formulae of Claim 20 and δ represents a change in robot position from the positioning station g when compensation is made.

23. (Amended) The method of Claim 1, further comprising determining the nominal robot position for use in compensating for the substrate drift by intentionally inducing a drift, measuring the induced drift and calculating reference substrate position based upon the measured induced drift.

37. (Amended) The method of Claim 36, wherein f_i is proportional to a lateral distance between two parallel sensors of the sensor system.

REMARKS

Prior to examination on the merits, Applicant has amended the application to correct obvious grammatical errors and to harmonize the claim language and specification teachings. Applicant respectfully submits that no new matter is added. The amendments to the specification are consistent with the teachings of the application as a whole. The amendments to the claims merely attempt to match follow-on recitations with their antecedents. Claim 37 is amended to complete an incomplete claim as filed, but is fully supported by the application as filed.

In view of the foregoing amendments, Applicant respectfully submits the application is in condition for examination on the merits and respectfully requests the same.

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Attached hereto is a separate paper entitled VERSION OF THE AMENDMENTS
SHOWING CHANGES MADE, in which additions are shown in double underlining and
deletions are shown ~~stricken through~~.

Respectfully submitted,

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VERSION SHOWING CHANGES MADE TO THE CLAIMS

IN THE SPECIFICATION:

The paragraph beginning on page 16, line 3 has been amended as follows:

The deviation in voltage readings are used to calculate 630 offsets Δ_L and Δ_R . Δ_L and Δ_R represent the linear deviations from the nominal wafer position, as measured longitudinally along the sensors (see Figure 12). Δ_L and Δ_R may be obtained from the following equation:

$$\Delta = \frac{l_{\max} - l_{\min}}{V_{\max} - V_{\min}} (V_{\text{ref}} - V)$$

Here, l_{\max} and l_{\min} represent maximum and minimum sensor laser beam lengths ~~blocked~~ left unblocked by the wafer, V_{\max} and V_{\min} represent the output value of the sensors when l_{\max} and l_{\min} are ~~blocked~~ left unblocked, V_{ref} indicates the sensor output value when the reference wafer is at the nominal wafer position while the robot is at its nominal centering position, and V indicates the sensor output value when the process wafer is at the nominal wafer position and the sensor is thus partially blocked. For the illustrated embodiment, $l_{\max} = 10$ mm, $l_{\min} = 0$ mm, $V_{\max} = 5$ V, and $V_{\min} = 0$, so that

$$\Delta = 2(V_{\text{ref}} - V)$$

IN THE CLAIMS:

10. (Amended) The method of Claim 9, wherein each of the at least two proportionate sensors are partially blocked by a leading edge of the reference ~~wafer~~ substrate at a second nominal robot position when the reference substrate data is recorded, and further comprising recording additional reference substrate data when each of the at least two proportionate sensors are partially blocked by a trailing edge of the reference ~~wafer~~ substrate.

17. (Amended) The method of Claim 16, wherein calculating drift parameters (x, y) of the process substrate from the nominal ~~wafer~~ substrate position comprises

calculating linear deviation Δ of an interception point of the process substrate edge relative to the reference ~~wafer~~ substrate interception point for each of the at least two proportionate sensors;

calculating a lateral spacing f of each sensor from an axis of robot translation; and

calculating the drift parameters (x, y) from the linear deviations Δ , f and the substrate diameter d .

19. (Amended) The method of Claim 17, wherein, for each sensor,

$$\Delta = \frac{l_{\max} - l_{\min}}{V_{\max} - V_{\min}} (V_{\text{ref}} - V)$$

where l_{\max} and l_{\min} represent maximum and minimum sensor lengths blocked by the ~~wafer~~ substrate, V_{\max} and V_{\min} represent the output value of the sensors when l_{\max} and l_{\min} are blocked, V_{ref} indicates the sensor output value when the ~~wafer~~ substrate is at the nominal position, and V indicates the sensor output value when the process substrate is at the nominal ~~wafer~~ substrate position.

20. (Amended) The method of Claim 19, wherein (x, y) are calculated using the following formulae:

$$x = \frac{1}{2} \left[f_L - f_R + \sqrt{\left(\frac{d}{s}\right)^2 - 1} \left(\Delta_L - \Delta_R + \sqrt{\left(\frac{d}{2}\right)^2 - f_L^2} - \sqrt{\left(\frac{d}{2}\right)^2 - f_R^2} \right) \right]$$

$$y = \frac{1}{2} \left[-\sqrt{\left(\frac{d}{s}\right)^2 - 1} (f_L + f_R) + \left(\Delta_L + \Delta_R + \sqrt{\left(\frac{d}{2}\right)^2 - f_L^2} + \sqrt{\left(\frac{d}{2}\right)^2 - f_R^2} \right) \right]$$

$$s^2 = (f_L + f_R)^2 + \left(\Delta_L - \Delta_R + \sqrt{\left(\frac{d}{2}\right)^2 - f_L^2} - \sqrt{\left(\frac{d}{2}\right)^2 - f_R^2} \right)^2$$

wherein d represents the ~~wafer~~ substrate diameter, Δ_L and Δ_R are the ~~wafer~~ substrate deviations of the two sensors, and f_L and f_R are the lateral spacing from left and right sensors, respectively, to an axis of robot translation.

21. (Amended) The method of Claim 20, further comprising determining the nominal robot position by:

moving the robot with the reference substrate to the nominal robot position;

rotating the reference ~~wafer~~ substrate through an angle θ_g ;

calculating an x_g displacement resulting from rotating through the angle θ_g using the formula for x in Claim 20; and

obtaining a value g by substituting the value of x_g obtained into the following formula:

$$g = \frac{x_g}{\sin \theta_g}$$

22. (Amended) The method of Claim 21, wherein compensating for substrate drift comprises changing the position of the robot supporting the process ~~wafer~~ substrate in accordance with the following formulae:

$$\Delta\theta = \sin^{-1} \left(\frac{-x}{\sqrt{x^2 + (g + \delta + y)^2}} \right)$$

$$\Delta R = g + \delta - \sqrt{x^2 + (g + \delta + y)^2}$$

where ΔR indicates a compensating change along the translation axis, $\Delta\theta$ indicates a compensating change in rotational position, g is calculated from the formula of Claim 21, (x, y) are calculated from the formulae of Claim 20 and δ represents a change in robot position from the positioning station g when compensation is made.

23. (Amended) The method of Claim 1, further comprising determining the nominal robot position for use in compensating for the substrate drift by intentionally inducing a drift,

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measuring the induced drift and calculating reference ~~wafer~~ substrate position based upon the measured induced drift.

37. (Amended) The method of Claim 36, wherein f_i is proportional to a lateral distance ~~from the~~ between two parallel sensors of the sensor system.

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